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09/752,541	12/29/2000	Stephen Boyd	4363P001	1435

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EXAMINER	
VU, TUAN A	
ART UNIT	**PAPER NUMBER**
2124	

DATE MAILED: 02/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/752,541	Applicant(s) BOYD ET AL.	
	Examiner Tuan A Vu	Art Unit 2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 January 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5-11 and 23-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5-11 and 23-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the application filed 1/14/2005. As indicated by Applicants, claim 5 has been amended, claims 1-4, 12-22 canceled, and claims 23-52 added. Claims 5-11, 23-52 submitted for examination.

Claim Objections

2. Claims 24 and 39 are objected to because of the following informalities: There appears to be a missing connecting term between 'said algebraic expression' and 'an internal variable'. Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 23, 24, 29, 38, 39 and 44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 23, 29, 38, and 44, the term "acceptable to" (line 3, 3, 4, 4, respectively) is a relative term which renders the claim indefinite. The term "acceptable" is not defined by the claim not explicitly in the specifications, i.e. what constitutes *accepted* and what constitutes *not accepted*, and to what specific extent. The specification mentions about a unique format with matrix structures specific for a solver (CNF - pg. 11-12); but the specification does not provide a standard for ascertaining the requisite degree implied by 'acceptable to … solver', and one of

ordinary skill in the art would not be reasonably apprised of the scope of the invention. The limitation hence will be interpreted as 'accepted by'.

Claims 24 and 39 are recited without a connecting term between 'said algebraic expression' and 'an internal variable'; thus do not provide sufficient teaching so to enable one of ordinary skill in the art to be apprised on the claimed feature referred to as 'substitution'. The limitation will be treated as though a substitution that replaces a variable referred by an expression.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shao-Po et al., "A Parser/Solver for Semidefinite Programs with Matrix Structure", Technical Report, Information System Laboratory, Stanford University, November 1995 (hereinafter Shao-Po – provided in IDS), in view of Hershenson et al., USPN: 6,311,145 (hereinafter Hershenson), and further in view of Dennis Bricker, "Signomial Geometric Programming", University of Iowa, April 1999, http://css.engineering.uiowa.edu/~dbricker/Stacks_pdf8/Signomial_GP.pdf (hereinafter Bricker).

As per claim 5, Shao-Po discloses a computer-implemented method of parsing a mathematical optimization problem comprising:

reading a plurality of algebraic expressions that represent a mathematical problem, each algebraic expression in said plurality having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

creating a set of mathematical expressions or constraints from the mathematical terms(e.g. *equality constraints* - ch. 4.3.1 pg. 85; *Lyapunov inequality* - ch. 4.4.1, pg. 86);

converting said set of constraints expressions to a optimized compact numeric format to be accepted by a program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89 – Note: compacting separate math expression into one matrix format reads on compact numeric format).

But Shao-Po does not specify that the mathematical terms or constraints are converted into a set of signomial expressions; nor does Shao-Po explicitly specify converting those set of signomial expressions into a format accepted by the geometric program solver. However, Shao-Po discloses parser/solver using software *MatLab*, *Bison* and *Flex* (see ch. 4.3 – pg. 84); hence has disclosed submission of matrix-implemented/geometric constraints into a computer-based geometric program solver. Shao-Po further discloses an implemented method for optimizing of circuit design (ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) using a *sdpsol* language programming (e.g. ch. 4.2.3 pg. 83-84. The matrix-implemented/geometric expressions using objectives and constraints are indicative of, or implicitly disclose that a form of signomials; and in case Shao-Po does not already teach that those constraints are signomial forms, such feature would have been obvious.

Hershenson, in a analogous method to Shao-Po's to optimize a circuit design lumping parametric constraints into a specific set of expressions, discloses optimizing complex non-linear

problems (e.g. induction or RF mathematics are non-linear as in Shao-Po's differential equation applying Lyapunov's case) and expressing the constraints or inequalities into posynomials and submitting these to solver using a geometric programming language (e.g. Fig. 1; col. 5, line 34 to col. 10, line 45). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the constraints as taught by Shao-Po into sygnomial expressions (Note: posynomial is interpreted as poly form of single sygnomial) as taught by Hershenson if the resources are such that Hershenson's geometric programming language can be implemented because this widely known programming technology operating upon convex or non-linear complex functions can be an efficient tool for effecting improved algorithms to solve problems like those non-linear complex inductive circuitry; and optimizing circuit designs as mentioned by Shao-Po, by solving constraints formed as posynomials, or set of sygnomials as claimed (see Hershenson, col. 1, 2).

Nor does Shao-Po disclose that at least one of the signomial expressions has a negative coefficient. Solving non-definite and complex problems such as Shao-Po's method implies dealing with complex, imaginary numbers or floating points and real numbers; and implementing geometric programming with signomials similar to Shao-Po, with such signomials handling non only positive coefficients but also negatively signed coefficients is evidenced in Bricker's approach (Signomial function, *sign of coefficient* - pg. 1). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the constraints as taught by Shao-Po' matrix posynomials so that the coefficients can be negative as taught by Bricker because of the increased power in dealing with more complex situations and enhance the

range of coefficient to address both negative and positive domain of the signomials as shown by Bricker.

As per claim 6, Shao-Po discloses an objective (eq. 4.1- pg. 79) and a set of constraints (e.g. *constraint lyap, constraint equ* – ch. 4.2.2 pg. 84).

As per claim 7, Shao-Po discloses one or more mathematical expressions (e.g. ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) and inequality (e.g. *Lyapunov inequality* – ch. 4.4.1, pg. 86).

As per claim 8, Shao-Po discloses optimization variables (matrices, vector – ch. 4.2.3 – pg. 83- Note: matrix or structures used for the optimization process are optimization variables)

As per claim 9, Shao-Po discloses before converting determining that the mathematical expressions reduce to objective or inequality or equality (e.g. ch. 4.2.2-4.2.3 pg. 83-84); but does not specify reducing expressions into posynomial expressions or determining that such optimization problem is a geometric program. This limitation, however, would have been obvious in view of the rationale set forth in claim 5 using Hershenson's teachings.

As per claim 10, only Hershenson discloses that some expressions are not posynomial expressions (col. 7, line 56 to col. 8, line 27). In light of the rationale set forth in claim 5, it would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the step of determining which expressions are not fit to be further converted into posynomial form as taught by Hershenson and apply such determination step to the problem solving using constraints-based optimization language by Shao-Po; because if the purpose is to convert complex functions constraints and parameters into posynomial forms, it is required to

only focus on creating posynomial expressions and filter out non-posynomial expressions in order to conform to the geometric programming as suggested by Hershenson.

But neither Shao-Po nor Hershenson discloses reporting to a user which expressions cannot be reduced into a posynomial objective or equality/inequality. The implemention of user interface in computer-implemented hardware/software design or circuit emulation framework in order to allow user to author or specify requirements and receive feedback from constraints compatibility checking was a known concept in the programming art at the time the invention was made, especially when such design involve CAD tools as suggested by Hershenson (col. 1, 2) or *LMITool* by Shao-Po (e.g. ch. 4.1.4 - pg. 82). It would have been obvious for one of ordinary skill in the art at the time the invention was made to add to the combination of Hershenson/Shao-Po an user interface allowing the user to interact with the circuit design and algorithmic programming as suggested by Hershenson; as well as the reporting to the users to the effect that some expressions fail to be reduced into posynomial objective or equality/inequality as claimed above. The motivation is that this would allow the user to specify and learn upon the results of such requirement acceptance by the framework or optimization of parameters used in implementing the functions of the circuitry, as applied by common known methodologies like HDL, Verilog-based hardware/software circuit designs.

As per claim 11, the reduction of simple monomial expressions into more posynomial has been taught and addressed in claim 5 (see Hershenson: col. 5, line 34 to col. 10, line 45-- Note: the monomial expressions representing signal mathematics in a circuitry used to be converted in more complex posynomial are mathematical expressions expressing signals, hence signomial); but Hershenson does not explicitly specifying canceling a combination of

signomials. Official notice is taken that simplication of mathematical expressions prior to submitting them to more complex integrations was a known concept at the time the invention was made. Hence it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the simplification by canceling out signomial combinations in view of the in both optimization methods by Hershenson or Shao-Po, and apply such canceling to Hershenson's method as it enhances the optimization method by Shao-Po as set forth in claim 5 because simplifying a mathematical expression or in this case signomial combination is a must-do step in computation lest extraneous data complications and resources wasting down the later computing stages occur.

As per claim 23, Shao-Po discloses computer implemented method, comprising:

converting a plurality of algebraic expressions that represent a geometric program into a format that is acceptable to computer-based program solver (e.g. *parser*, *MatLab*, *Bison*, *Flex* -- see ch. 4.3 – pg. 84), said converting comprising for each algebraic expression of said plurality of algebraic expressions (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89 – Note: compacting separate math expression into one matrix format reads representing algebraic expressions of a geometric program into an accepted format for the program solver):

converting said algebraic expression into a matrix-implemented/geometric expression by converting terms of said matrix-implemented expression into a matrix-implemented/geometric function (ch. 4.2.2-4.2.3 pg. 83-84; ch. 4.3, 4.4, pg. 84-88 – Note: example 4.13 by Lyapunov reads on function converted from a generic geometric expression to perform a real-life function);

But Shao-Po does not explicitly disclose that the matrix-implemented/geometric expression is a signomial; nor does Shao-Po disclose reducing said signomial expression to one

of the following: a posynomial objective, a posynomial inequality, a monomial equality; but the rationale as to why the signomial limitation would have been obvious has been set forth in claim 5. Further, Shao-Po discloses objective, constraints including inequalities (e.g. ch. 4.2.2-4.2.3 pg. 83-84), hence the posynomial objective, a posynomial inequality, a monomial equality limitations would also have been obvious in light of the signomial limitation being obvious as set forth in claim 5.

As per claim 24, Shao-Po discloses making a substitution of an internal variable that represents a previously assigned expression (e.g. *support, assigned internal variables ... later be used* --pg. 82, ch. 4.2.1 – Note: parser to support internal variable definitions reads on substitution for implementing program solving expressions).

As per claim 25, Shao-Po teaches algebraic manipulation (re claim 5) but Shao-Po does not explicitly disclose simplifying the signomial expression by canceling two identical signomial functions of opposite sign; but the concept of canceling two entities with opposite sign is an implicit and basic teaching in all mathematical operations; hence this is implicitly disclosed.

As per claim 26, Shao-Po discloses finding said algebraic expressions within lines of an input source file (e.g. *support, assigned internal variables ... later be used* --pg. 82, ch. 4.2.1 – Note: Matlab like grammar reads on lines of source code being parsed based on grammar rules).

As per claim 27, Shao-Po (combined with Hershenson/Brisker) discloses each one of said algebraic expressions is one of the following: an objective function; an equality constraint, an inequality constraint (refer to claim 23).

As per claim 28, Shao-Po (combined with Hershenson/Brisker) discloses that said geometric program is a signomial program (ch. 4.2.2-4.2.3 pg. 83-84 and the teachings by Hershenson and Brisker as set forth in claims 23, 5).

As per claim 29, Shao-Po discloses a computer implemented method, comprising:

converting a plurality of algebraic expressions that represent a geometric program into a format that is acceptable to geometric program solver software (e.g. ch. 4.3 pg. 84; *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89), said converting comprising for each algebraic expression of said plurality of algebraic expressions (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

combining mathematical terms of said algebraic expression to reduce said algebraic expression to one of the following: a objective, an inequality, an equality (e.g. ch. 4.2.2-4.2.3 pg. 83-84).

But Shao-Po does not disclose that the reduced form of objective, inequality, equality are respectively a posynomial objective, a posynomial inequality, a monomial equality; but in view of the similarity of matrix-implemented implementing of geometric problems of Shao-Po and posinomials by Hershenson, these limitations would have been obvious as set forth in claims 5 and 23.

As per claims 30 and 31, these claims refer to mathematical terms identifying one of the group of signomial, posinomial, monomial; but since these forms have been addressed in claim 29; these limitations would have been obvious also owing to the implicit teaching that any mathematical polynomial can be either poly/mono-mial and to the posinomials/signomial teachings from the combination Shao-Po, Hershenson and Birsker as set forth in claim 5.

As per claim 32, Shao-Po does not explicitly disclose that said combining mathematical terms comprises determining if operators and functions that relate said mathematical terms permit said reduction. Official notice is taken that reduction of mathematical expression being based on operator (e.g. division, left and right side of equality, multiplication by same number) and type of expressions (common denominator/factor, most common divisor, parentheses... etc) under which those math terms are formed. Thus, based on such well-known, the reduction provided via Software like Mathlab, for example, as taught by Shao-Po implicitly disclose determining if operators and functions that relate said mathematical terms permit said reduction.

As per claims 33 and 34, Shao-Po does not explicitly disclose that said posynomial inequality is a posynomial function less than one and said monomial inequality is a monomial function equal to one. But the chance that a polynomial or posinomial or a monomial be less than one or equal to one is not excluded from all the possible values taken from resolving the matrix-implemented geometric expressions as taught by Shao-Po (ch. 4.3, or 4.4, pg. 84-91). Hence, Shao-Po has disclosed the limitations of claims 33 and 34.

As per claims 35-37, these claims are rejected with the same rationale as set forth in claims 26-28, respectively.

As per claim 38, Shao-Po discloses a method comprising:

converting (a plurality of algebraic expressions that represent a geometric program...)

converting (into a ... expression by converting terms ... into a ...); all of which steps being the same as recited in claim 23.

These limitations thus are rejected using the corresponding rejection as set forth therein.

But Shao-Po does not disclose program code embedded on a readable medium which when executed by a computer causes a method to perform the above steps limitations. But the providing of software embodied in a readable medium for solving a problem would have been obvious in today's selling of product using Matlab or other parsing tools such as taught by Shao-Po.

As per claims 39-43, these claims correspond to claims 24-28; and are rejected with the same rationale as set forth in claims 26-28, respectively.

As per claim 44, this claim corresponds to claim 29; and is rejected with the corresponding rejection as set forth therein, and further includes the computer–readable medium as addressed in claim 38.

As per claims 45-52, these claims are rejected with the same rationale as set forth in claims 30-37, respectively.

Response to Arguments

7. Applicant's arguments filed 1/11/2005 have been fully considered but they are not persuasive. While most of the Applicants observations concern with the new added limitations for which new grounds of rejection are necessitated, some remarks about geometric program solver and *sdpsol* parser need to be addressed.

Applicant has submitted that Shao-Po is merely directed to a parser for semidefinite programming (Appl. Rmrks, pg. 12 last para) and neither Shao-Po or Hershenson is actually addressing a parsing process as claimed. The claims in general recite the steps of converting and reducing; and all of these steps are met by the rejection. The parsing limitation, if considered a essential and distinguishing feature of the application, did not appear to be recited in ways so to

clearly distinguish over what has been cited from Shao-Po. Merely arguing that the claims 'are largely' directed toward a clear 'parsing process' does not point out why Shao-Po's cited parts fail to meet what is required from those converting and reducing steps, notwithstanding the fact that when a term is mentioned in the preamble (e.g. *method of parsing* - as in claim 5), it has to be supported by further description in the body of the claim. And the body of the claim is what the rejection is effected upon. Besides, the rejection has pointed to portions by Shao-Po showing that a parser is implemented to derive what variables are used from a programming language in order to construct the matrix like geometric expressions. Thus, software parsing there is if any doubt exists. Hence, the arguments above amount to mere assertion without pointing out how the claimed features distinguish over the prior art as set forth in the rejection.

The rejection will stands as set forth.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan A Vu whose telephone number is (272) 272-3735. The examiner can normally be reached on 8AM-4:30PM/Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (571)272-3719.

The fax phone number for the organization where this application or proceeding is assigned is (571) 273-3735 (for non-official correspondence – please consult Examiner before using) or 703-872-9306 (for official correspondence) or redirected to customer service at 571-272-3609.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

VAT
February 15, 2005

Kakali Chaki

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